

**WHAT IS CLAIMED IS:**

1. A multiple zone gas distribution apparatus for controlling temperature across a workpiece during processing, the apparatus comprising:
  - a chuck having a top face configured to hold a workpiece during processing, the chuck top face defining inner and outer zones between the top face of the chuck and the workpiece into which zone coolant gas may be admitted;
  - inner and outer zone feed lines for feeding the coolant gas to the inner and outer zones of the chuck;
  - a pressure and flow control system for supplying zone coolant gas to the feed lines with separate pressure for the inner and outer zones controlled to control the temperature across the workpiece; and
  - inner and outer zone bleed lines connected to the inner and outer zone feed lines between the pressure and flow control system and the chuck, the inner zone bleed line having a fixed orifice for continuous bleeding of the pressure of the inner zone during processing of the workpiece, and the outer zone bleed line having a evacuation valve for pressure release.
2. The apparatus of Claim 1, wherein the outer zone bleed line evacuation valve is closed during processing of the workpiece and the outer zone pressure bleeds between the chuck and the workpiece to the surrounding chamber.
3. The apparatus of Claim 1, wherein the inner and outer zones are concentric circular zones.
4. The apparatus of Claim 1, wherein the inner and outer zones of the chuck top face each include a plurality of holes arranged in circular pattern for delivery of coolant gas.

5. The apparatus of Claim 5, wherein the inner and outer zones of the chuck top face include at least one shallow circular groove to provide easy flow of coolant gas from the plurality of holes in a circular direction along the underside of the wafer.

6. The apparatus of Claim 1, wherein the pressure and flow control system controls the supply of zone coolant gas to the feed lines to achieve different pressures in the inner and outer zones throughout the processing of a workpiece to control the temperature across the workpiece.

7. The apparatus of Claim 1, wherein the inner zone bleed line has a evacuation valve which bypasses the fixed orifice for immediate inner zone evacuation, the inner and outer evacuation valves allowing evacuation of the inner and outer zones in 5 seconds or less.

8. An apparatus for detecting dechucking in a multiple zone wafer cooling system, the apparatus comprising:

a chuck having a top face configured to hold a workpiece during processing, the chuck top face defining inner and outer zones between the top face of the chuck and the workpiece into which zone coolant gas may be admitted;

first and second zone feed lines for feeding the coolant gas to the inner and outer zones of the chuck;

a pressure and flow control system for supplying zone coolant gas to the feed lines with separate pressure for the first and second zones controlled to control the temperature across the workpiece; and

first and second zone bleed lines connected to the first and second zone feed lines between the pressure and flow control system and the chuck, the

first zone bleed line having a fixed orifice for continuous bleeding of the pressure of the first zone during processing of the workpiece; and

wherein the pressure and flow control system for supplying coolant gas to the second zone feed line provides a signal indicating dechucking when the flow rate increases more than a predetermined amount.

9. The apparatus of Claim 8, wherein the first and second zones are concentric zones.

10. The apparatus of Claim 9, wherein the first zone is an inner concentric zone and the second zone is an outer concentric zone.

11. The apparatus of Claim 8, wherein the second zone bleed line includes an evacuation valve which is closed during processing of the workpiece such that the second zone pressure bleeds between the chuck and the workpiece to the surrounding chamber.

12. A method of distributing cooling gas to a backside of a workpiece in a semiconductor processing chamber, the method comprising:

holding a workpiece on a top face of a chuck, the chuck top face defining inner and outer zones between the top face of the chuck and the workpiece into which zone coolant gas may be admitted;

supplying zone coolant gas to the inner and outer zones;  
controlling the pressures of the zone coolant gas to maintain separate pressures for the inner and outer zones to control the temperature across the workpiece; and

continuously bleeding of the inner zone coolant gas through an inner zone bleed line orifice during processing of the workpiece; and bypassing the inner zone bleed line orifice to evacuate the inner zone coolant.

13. The method of Claim 12, further comprising evacuating the outer zone coolant gas through an outer zone bleed line by opening an outer zone evacuation valve.

14. The method of Claim 12, further comprising bleeding the outer zone coolant gas between the chuck and the workpiece into a surrounding chamber.

15. The method of Claim 12, wherein the inner zone coolant gas is evacuated from the inner zone to allow removal of the workpiece from the chuck in a transition time of 5 seconds or less.

16. The method of Claim 12, wherein the continuous bleeding of the inner zone coolant

17. A method of detecting dechucking in a multiple zone wafer cooling system, the method comprising:

holding a workpiece on a top face of a chuck, the chuck top face defining first and second zones between the top face of the chuck and the workpiece into which zone coolant gas may be admitted;

supplying zone coolant gas to the first and second zones;

controlling the pressures of the zone coolant gas to maintain separate pressures for the first and second zones to control the temperature across the workpiece; and

continuously bleeding the first zone coolant gas through an inner zone bleed line orifice during processing of the workpiece; and

detecting dechucking by sensing when a flow rate of zone coolant gas to the second zone increases more than a predetermined amount.

18. The method of Claim 17, wherein the first zone is an inner zone and the second zone is an outer zone concentrically surrounding the inner zone.

19. The method of Claim 17, further comprising evacuating the second zone coolant gas through a second zone bleed line by opening a second zone evacuation valve.

20. The method of Claim 17, wherein the first and second zone coolant gas is evacuated from the first and second zones to allow removal of the workpiece from the chuck in a transition time of 5 seconds or less.